

TESTS AND RESEARCH

Investigators from the Safety Board and UL Power Engines examined the wreckage on June 05, 2018 at the facilities of Plane Parts in Sacramento, California



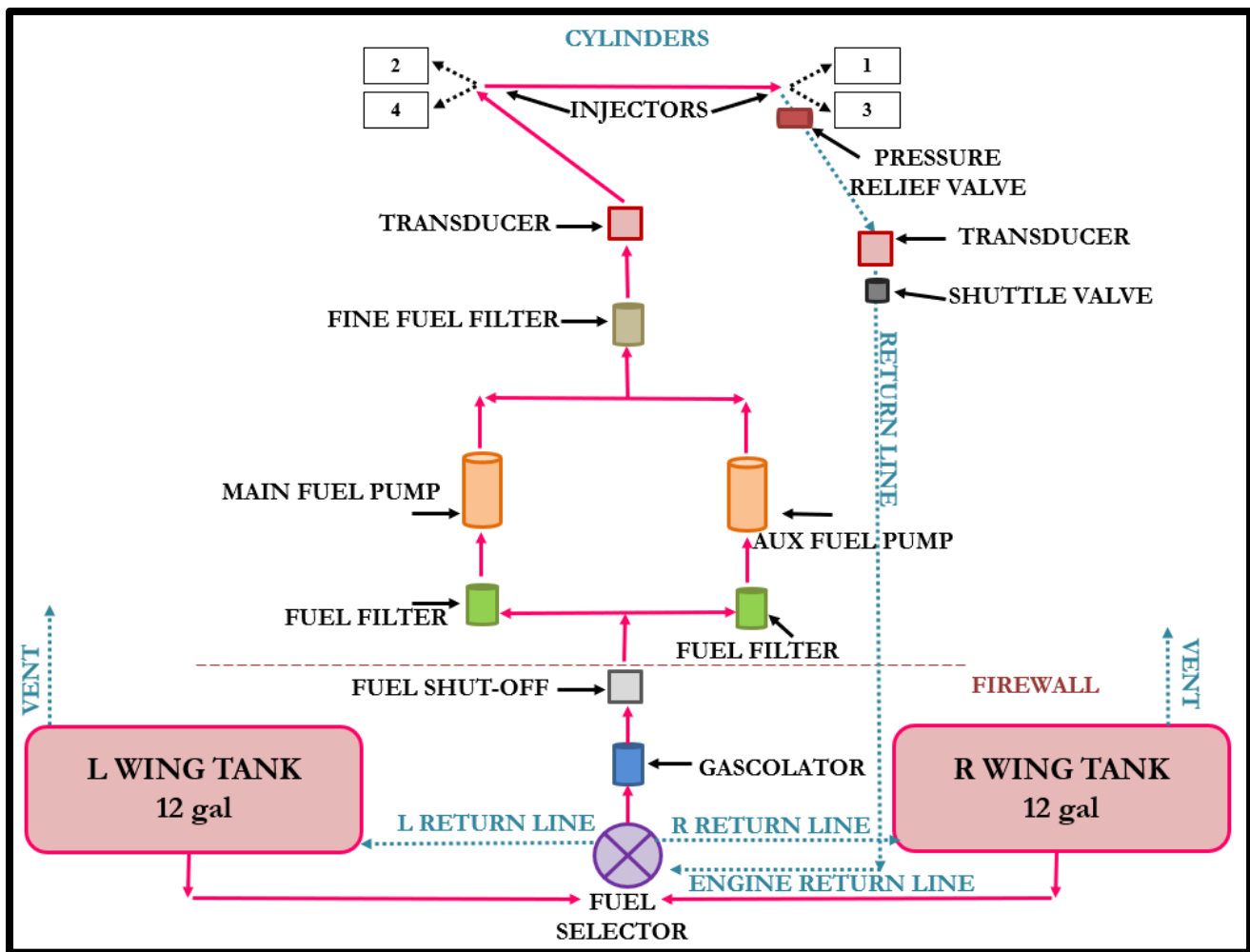
Picture 01: Wreckage

FUEL SYSTEM

FUEL SYSTEM DESIGN

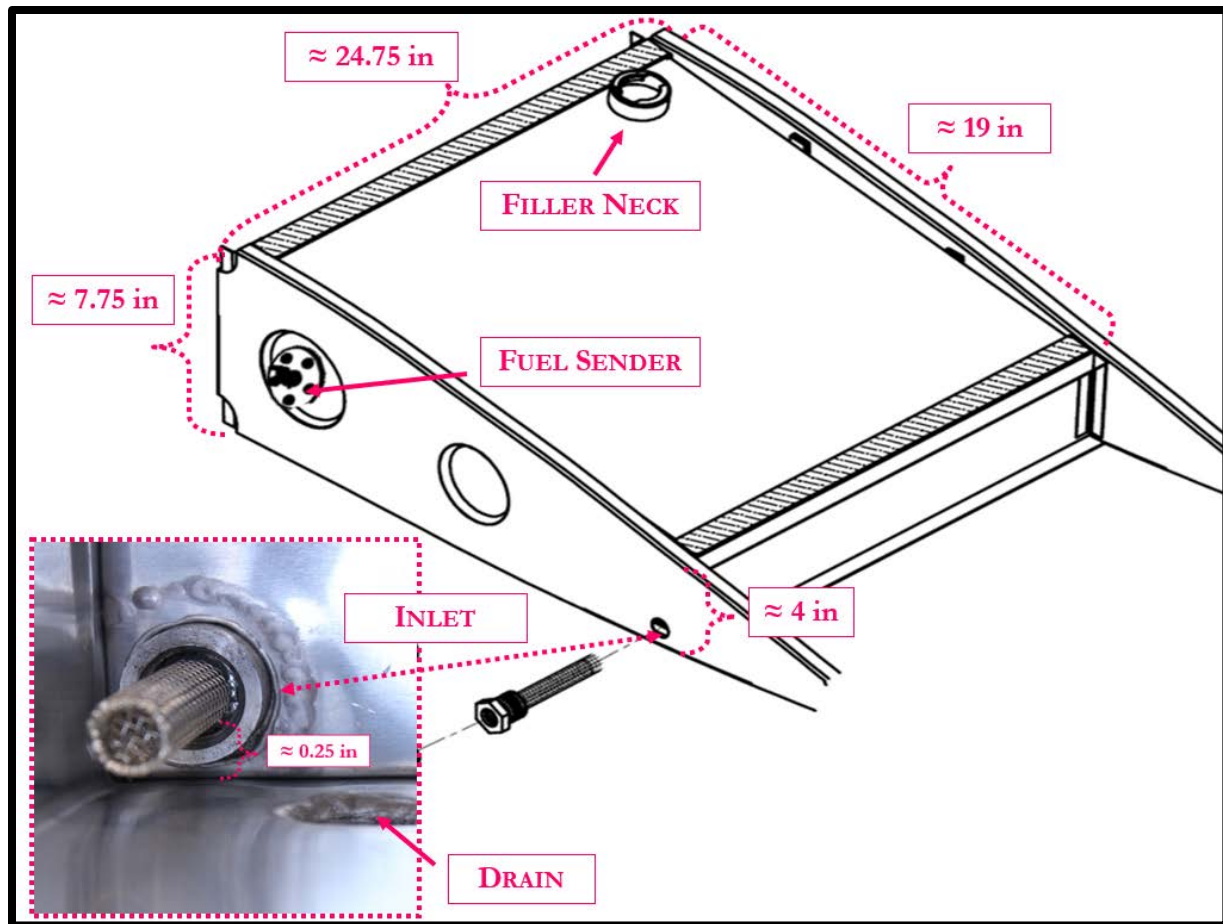
A post accident examination revealed that airplane's fuel system was a pressurized design where fuel flowed from the metal tanks in the inboard section of each wing to the engine. The connectors on the wings were a quick-disconnection type, where a collar had to be pulled back to connect the lines (fuel supply and return) from the tanks to the fuselage. The fuel was routed from the tanks to a selector valve. The selector was electronically activated from the panel switch which contained a right and left position. The fuel line then continued to a gascolator. From the gascolator, the fuel line was routed along the left side of the fuselage to a fuel shut-off valve located near the pilot's floor area.

The fuel continued through the firewall where there was a 90-degree elbow and the fuel would flow to either of the 2 fuel filters that were mounted on the firewall. Each respective filter was located just below the auxiliary fuel pump and the main fuel pump, where the fuel lines then combined and continued to the main fuel filter. The fuel line then was routed to a transducer and then to the injectors on the left side (cylinders Nos. 2 and 4) and then over the top of the engine to the right side (cylinders Nos. 1 and 3). The fuel return line from the cylinders was on the right side of the engine and routed to the pressure relief valve. From there, the fuel continued passing through another transducer and a check valve before going through the firewall. Thereafter, the fuel returned to the selector and was routed to the tank selected on the fuel selector.



Picture 02: Fuel System as Found on the Airplane

The metal tanks were rectangular 24.75 in long by 19 in wide and the forward height was about 7.75 in with the aft wall height about 4 in. The fuel inlet was located on the inboard wall of the tank in the aft area and had a screen attached. The inlet was about 0.25 in above the floor of the fuel tank.

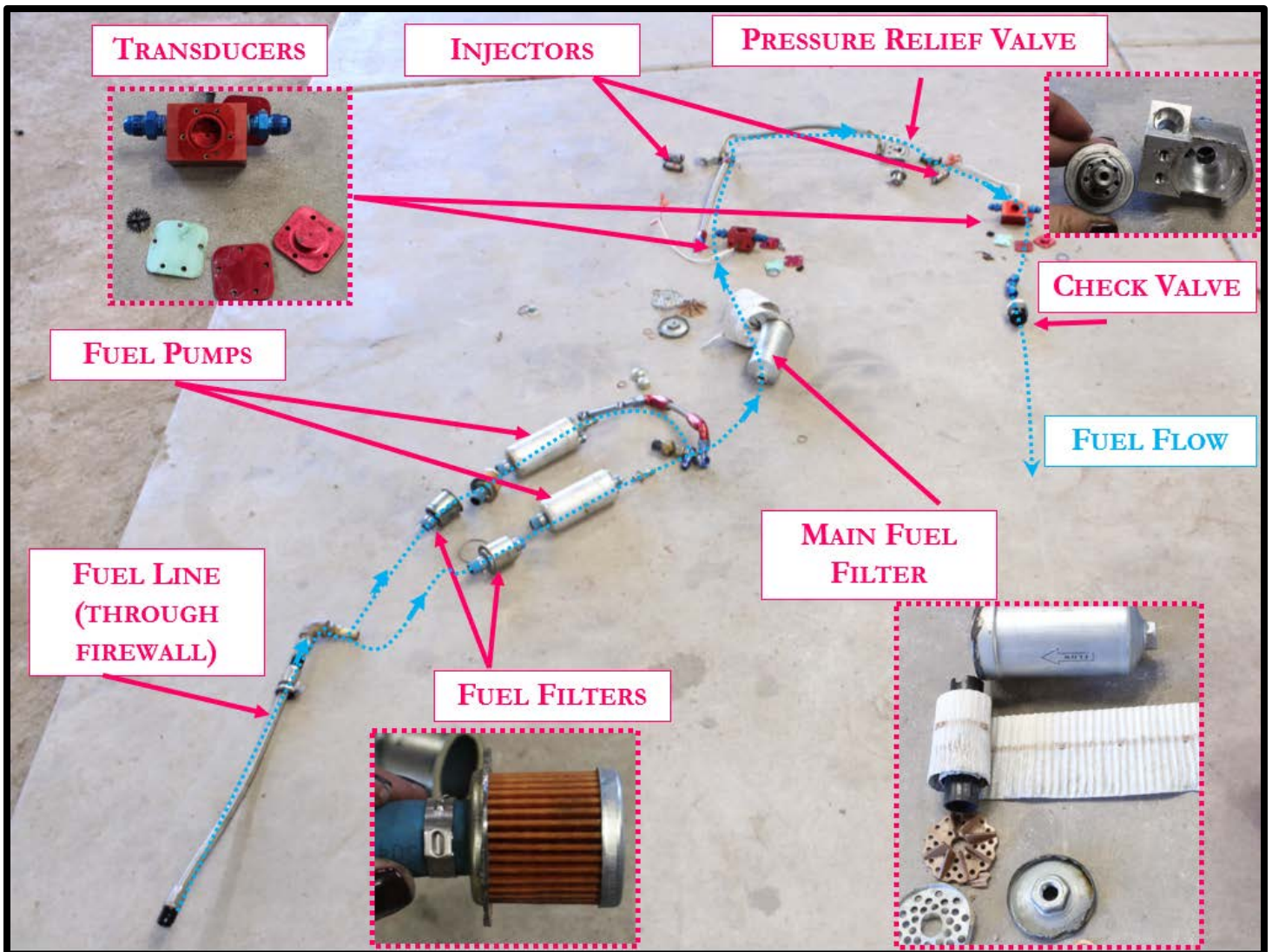


Picture 03: Wing Fuel Tanks

FUEL SYSTEM EXAM

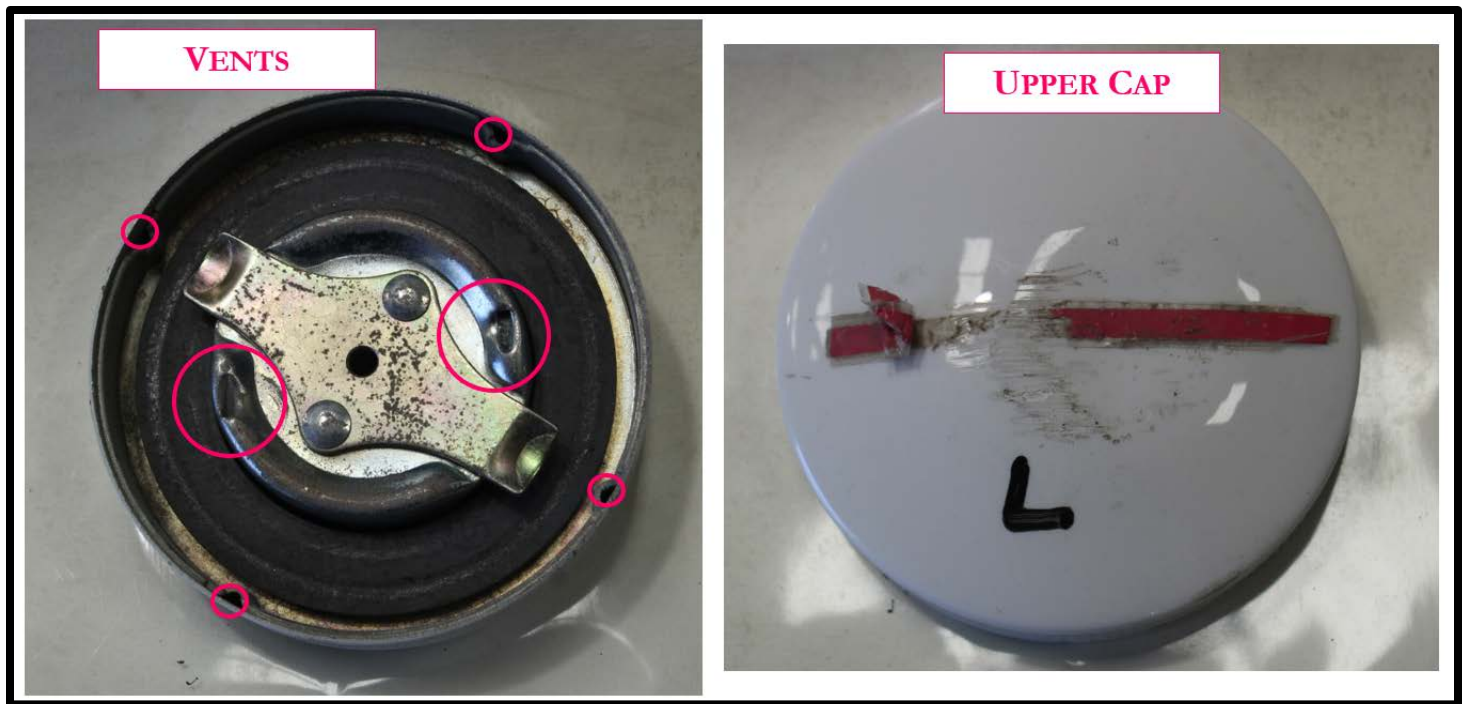
Investigators disconnected the fuel line between the fuel selector and gascolator and activated the fuel pumps. No suction could be felt, but the fuel pumps could be heard operating. The fuel line was then disconnected between the fuel shut-off and the gascolator and again no suction could be felt. The line was then disconnected at the 90-degree elbow forward of the firewall and the slight suction could be felt (momentary surges). The fuel line between the fine filter and the transducer was loosened and the suction at the line from the 90-degree elbow produced a strong suction and fuel forcefully came out of the loosened line.

The lines were all removed and found to be clear. The filters were disassembled and were clean with no debris noted. Removal of the paper element in the main filter revealed a material contained in the pleats, which was consistent with an adhesive that was used to bind the element to the casing. The transducers were disassembled and the wheels spun freely. The fuel injectors were free of debris. The pressure relief valve was disassembled and no anomalies were found.



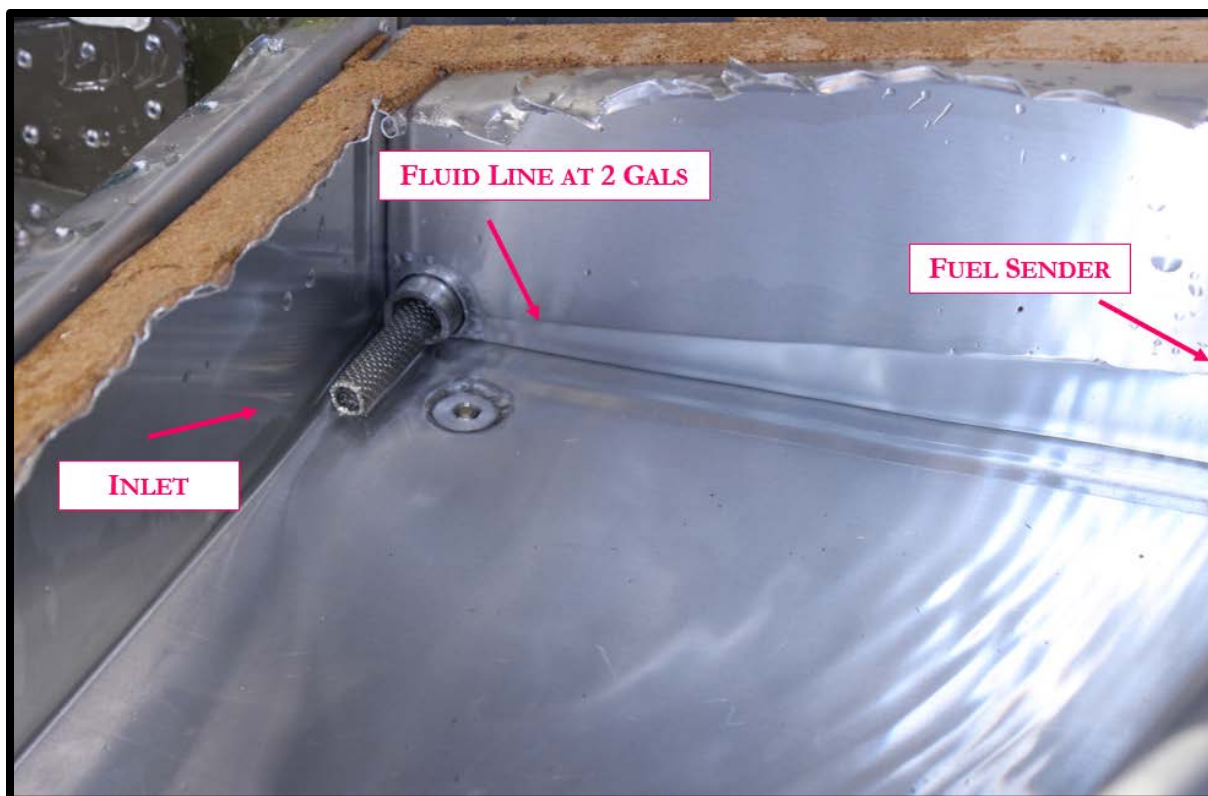
Picture 04: Fuel System Examined

The fuel caps remained secure on the tanks. When investigators forced air into the inlet, the left tank pressurized until removing the fuel cap. The same occurrence with the right tank, but with less pressurization occurring and air could be heard escaping the cap.



Picture 05: Fuel Caps

Investigators added 2 gallons of water in the left tank and attempted to position the wing in an estimated wings-level attitude. The water came to the lower lip of the inlet just touching the lower surface of the cylindrical screen body consistent with the fluid not being available to the enter the inlet if the wing changed attitude of being tilted forward (replicating a descent) or right (replicating a right turn).



Picture 06: Fuel Tank with 2 Gallons Added in Estimated Wings-Level Attitude.

ENGINE EXAMINATION

The airplane was secured to a forklift and weighted down. Oil was added and a fuel source was attached to the inlet fuel line prior to entering the dual fuel filters; the right tank was selected and a hose was plumbed from the right return line to a bucket to route the excess fuel into a bucket. The engine was successfully started and ran for over 3 minutes at an idle power settings from 800 to 1,000 rpm with no irregularities noted; this was repeated a second time. The engine was shut down the first time by shutting off both fuel pumps (took about 20 seconds to quit) and the second time by shutting the power off.

During the second engine run, when the right return line was removed, the engine continued to run with no anomalies noted.

No mechanical anomalies were noted with the recovered engine or airframe that would have precluded normal operation.